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ABSTRACT

Lockheed Space Operations Company's Technical Training Department provides certification classes to personnel at other National Aeronautics and Space Administration (NASA) Centers. Courses are delivered over the Kennedy Space Center's Video Teleconferencing System (ViTS). The ViTS system uses two-way compressed video and two-way audio between participating sites. Technical Training's goal is to conduct distance learning classes at least equal to those conducted on-site at the Kennedy Space Center. Formal and informal evaluation techniques are used to evaluate the program. Fifteen distance learning classes were offered by Lockheed Technical Training during 1992, resulting in a savings of approximately $50,000 in travel expenses. (Author)

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DISTANCE LEARNING AS A TRAINING AND EDUCATION TOOL

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ABSTRACT

Lockheed Space Operations Company's Technical Training Department provides certification classes to personnel at other National Aeronautics and Space Administration (NASA) Centers. Courses are delivered over the Kennedy Space Center's Video Teleconferencing System (ViTS). The ViTS system uses two-way compressed video and two-way audio between participating sites. Technical Training's goal is to conduct distance learning classes at least equal to those conducted on-site at the Kennedy Space Center. Formal and informal evaluation techniques are used to evaluate the program. Fifteen distance learning classes were offered by Lockheed Technical Training during 1992, resulting in a savings of approximately $50,000 in travel expenses.

TRAINING VERSUS EDUCATION ENVIRONMENT

Lockheed Space Operations Company is the primary contractor for space shuttle processing at the Kennedy Space Center. Lockheed's Technical Training Department, like other corporate training organizations, conducts classes which are job-related; that is, they are tied to the performance of certain tasks. At the Kennedy Space Center, these tasks may be launch critical and usually involve a number of safety requirements.

Once a worker's certification to perform a specific task has expired, he cannot perform that job. As a result, training requirements for company employees must be reviewed and scheduled on a regular basis. Training is on demand and dynamic. Deadlines may be imposed by an outside organization, such as Safety, when government regulations dictate.

In the education world, public schools and universities must deal with student enrollment and requirements for graduation. Funding, availability of teachers and facilities, and student demand are issues which affect classes. Education is fairly stable and less time sensitive than corporate training, which is tied to operational requirements. The differences between the training and education environments naturally influence the design and implementation of a distance learning program.

When Lockheed approached NASA about developing distributed training, the rationale was to eliminate travel expenses and reduce employee time away from the job. The challenge was to provide quality instruction using distance learning technology. In 1991, the Company received permission from NASA to use Kennedy Space Center's Video Teleconferencing System (ViTS) for training. In one year, the use of distance learning methodology reduced travel expenditures by nearly $50,000.

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NASA'S VIDEO TELECONFERENCING SYSTEM (ViTS)

The Video Teleconferencing System (ViTS) facilities are designed specifically for meetings between various NASA Centers. The ViTS rooms are available to all government contractors free of charge, so Lockheed received the full benefits of the latest technology at no cost. The only restriction was that classes must begin after 4 p.m. Eastern Standard Time to avoid conflict with scheduled meetings.

Using NASA's Program Support Communications Network (PSCN), two or more sites can participate in a class from a ViTS facility. The Video Teleconferencing Control Center (VTCC) located at Marshall Space Flight Center provides central support for scheduling assistance, network switching and operations, and trouble resolution. By using the ViTS Automated Scheduling System (VASS), a ViTS coordinator can reserve video teleconferencing rooms, schedule network facilities, and validate configuration.

The network utilizes a combination of terrestrial and satellite transmission facilities connecting NASA sites, other government locations, key contractor sites, universities, and public networks. PSCN uses a digitally compressed video signal that reduces bandwidth requirements to approximately 90 Mbps.

The seating capacity for NASA ViTS facilities varies from 12 to over 50. Each seating position has access to a microphone and mute switch. During a multipoint video teleconference, audio is transmitted terrestrially via a 4-wire audio connection to the Marshall Space Flight Center conference bridging system.

Kennedy Space Center's ViTS facility is a full-service room with three video cameras, projection screens, a status indicator panel, audio equipment, graphics presentation equipment, and a remote control panel. It has these specific features:

- two-way audio between sites
- two-way full-motion video between sites
- freeze frame graphics, using the computer or overhead camera
- access to operational television cameras located at launch pads and other facilities on KSC

Two 67-inch projection screens are installed at the front of the room. One screen displays graphics or videotape playback. The other shows participants at the primary receiving site. If more than one site is participating, it is also possible to view secondary site(s).

DISTANCE LEARNING ISSUES

Although using the teleconferencing facility at KSC had been approved by NASA, Lockheed Technical Training still had to "sell" the idea of distance learning to management, the Safety organization, as well as instructors and students. The Company's biggest concern was whether distance learning is as effective as the traditional classroom experience.

Hands-on training came under the most scrutiny. In January 1993, a class in donning and operating breathing air equipment was presented by satellite. During this class, the instructor must verify that students have put equipment on properly. Adequate instructor verification was a concern to the Safety organization. As a result, a number of meetings between Safety and Training representatives were conducted to clarify what would take place in a distance learning classroom.

One selling point for Lockheed's distance learning program is that the teleconferencing facility has state-of-the-art equipment with two-way video and two-way audio. The room has three cameras which can be adjusted to show close-ups or various angles of a piece of hardware or equipment. Based on the video/audio setup and experience with other distance learning classes, Technical Training was able to convince Safety to allow breathing apparatus training by satellite.

Other issues such as funding and installing equipment, and corporate commitment were not as difficult to overcome. The equipment was already there, and it was just a matter of negotiating access. Corporate commitment was accelerated by the fact that no dollars were required to buy equipment or hire additional people.

DEVELOPING A DISTANCE LEARNING PROGRAM

Lockheed's first distributed training class, "Orbiter Hatch Operator", was presented to Dryden Flight Research Facility. The class is a requirement for personnel who must know how to open and close the crew module hatch during normal operations and emergencies. Several observers from the Technical Training Department attended the session. They thought the lecture went very well, but it was apparent the television medium presented some special challenges.

Some of the problems encountered in delivering a quality distance learning program are probably very similar to those in the education environment. Lockheed Technical Training found three major areas for improvement: instructor preparation, student acceptance, and quality visual presentations.

At the beginning of the program, there was a tendency by some instructors to dismiss this method of delivery as "no big deal." Others procrastinated and did not prepare, because they were apprehensive about appearing in front of a camera.

To alleviate this problem, instructors were encouraged to tour the ViTS facility, watch a demonstration of the equipment, and work with the camera operator on special requirements. By also observing a co-worker's class, instructors knew what to expect when their turn came. In addition, the coordinator for Technical Training's distributed training program attended a special conference on distance learning that focused on delivery techniques, issues, and concerns.

Initially, there was some resistance by students to distance learning, because it eliminated trips to Florida, and also because it physically separated them from the instructor. The first concern will eventually go away, since NASA has severely cut travel budgets. The second concern probably results from the fact that distance learning is something new and unfamiliar.

The last major area for improvement involved the visual materials used in class. Most instructor transparencies consisted of black and white engineering drawings taken from course handouts. Projected on a screen, they were often unreadable and hard to comprehend.

It did take some time and effort to improve these transparencies. Titles and text were redone in larger type. Copies were cleaned up or scanned to computer disk for enhancement. Most instructors agreed the end result was better than their original materials.

Instructors were also encouraged to supplement their presentations with photographs, videotapes, and actual equipment and hardware. In addition, they could access television cameras installed on Kennedy Space Center to show operations in progress or hardware configuration. A reference guide to operational television cameras allows instructors to select specific shots prior to class. The use of these cameras was especially important for students who had not been to the Kennedy Space Center.

STUDENT FEEDBACK

Student comments focused on areas needing improvement.

Some students expressed these concerns: "We don't like distributed training for hands-on classes" or "The instructor needs to be here with us." Technical Training's goal is to provide quality training, regardless of the methodology. Therefore, it is still an instructor's responsibility to develop a distance learning class which is at least equal to the traditional classroom situation; and students must be willing to participate in a new experience.

Instructors may be required to send videotapes, training aids, and materials to the sites prior to class. Students may have to check out and bring required equipment to class. Both instructors and students must put forth some effort for the program to work.

In mid-1992, Technical Training developed a course critique sheet to formally evaluate their distributed training classes. Ten items are rated by students on a scale of one to five, and there is additional space for written comments. Several items pertain specifically to the technology, such as audio and satellite picture.

Student comments were useful in evaluating the distance learning format. Students were good about letting Technical Training know if visual materials were readable, whether they had been given the proper information about the class from their training coordinator, and if there was enough time for questions.

One student wrote: "One suggestion to make folks feel more comfortable asking questions is instead of immediately starting with course materials, have a short five minutes at the beginning where the instructor asks a question or two of each site and we respond. It might take some of the intimidation factor out of it."

The instructors who received the best evaluations were those who prepared, were open to change, and recognized that distance learning is a different methodology.

LESSONS LEARNED

As the year progressed, Lockheed's distributed training program improved in efficiency and quality.

Currently, all scheduling and confirmation of distributed training classes is done by electronic mail or fax between Technical Training and the ViTS room coordinator. This was a mutual decision after a misunderstanding about the correct start time for a class occurred. Because the NASA Centers involved are in different time zones, using the computer or fax machine keeps phone coordination to a minimum and provides a permanent record of a transaction.

From the onset of the program, student participation was an issue. It became obvious that unless there was some interaction between instructor and students, there was no reason to use this technology. As a result, seating charts were created for each participating site. Students can write their name by seat location, and this information is faxed to KSC before class begins. The chart makes it easy for an instructor to address students by name and increase their participation.

The first distributed training classes were primarily lectures. The next stage was to have students perform tasks at a distance. During a "Working At Heights Safety" class, students put on fall protection gear for the instructor's evaluation. They also assessed the condition of their equipment with the instructor's help, and some problems were noted. This exercise increased the degree of student involvement and made the class more interesting.

Other improvements were made in the overall look of the program. A short introduction video was created to cue students that class was about to begin. In addition, a portable white board was custom-designed to be used with the overhead camera. This eliminated having the instructor change microphones and move to the white board at the front of the room.

CONCLUSION

In 1992, SPC Technical Training presented 15 classes via satellite from Kennedy Space Center to other NASA Centers. Some of the certification courses offered were Hypergolic Quick Disconnect Installation, Orbiter Toxic Vapor Detection, and training for hypergolic propellant handlers. Five classes were requested by Johnson Space Center to supplement their training program. These included familiarization courses in space shuttle systems and facilities, and solid rocker booster/external tank systems.

Some hands-on training via satellite is planned for 1993. This will involve increased coordination between KSC and NASA Centers to assure that proper equipment and materials are available to students in class. It will also involve greater participation by ViTS room operators at all Centers, so that cameras document student technique properly for instructor evaluation.

In 1993, SPC Technical Training will participate with NASA in the ACTS (Advanced Communications Technology Satellite) Experiments Program. ACTS is a new communications satellite which uses Ka Band technology and is scheduled to be deployed from the space shuttle in the summer of 1993. Lockheed's experiment involves distance learning in the area of hazardous materials and environmental safety training.

In addition to expanding the parameters of the medium, there are several areas for improvement and change in the distributed training program. Effective communication between SPC Technical Training personnel and training coordinators, ViTS room operators, and students is vital. Technical Training's objective is to increase the involvement and enthusiasm of all the players in this program.

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Dr. Hosley currently manages the U.S. Space Shuttle Contract Technical Training Program at Kennedy Space Center, Florida. The Technical Training Department conducted a FY 1992 monthly average of 373 formal classes and 10,172 student hours. The Department manages 382 training courses, 188 videotapes, and 579 on-the-job training packages. The subject areas are systems, safety, skills, and computers. Formal distant learning courses are provided from Florida to Texas, New Mexico, and California.

Dr. Hosley has over 30 years experience in the education and training business. Prior to his current position, he was a Senior Scientist, Institute for Simulation and Training, University of Central Florida, and Director, Airway Science Division, Florida Memorial College, where he managed the implementation of technology, to include satellite distance training, into academic and training programs.

He has a Ed.D in Educational Administration from the University of Arizona.

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Ms. Randolph currently coordinates the distributed training program and provides media support for the Shuttle Processing Contract. She is also Lockheed's principal investigator for NASA's Advanced Communications Technology Satellite (ACTS) Experiments Program.

Ms. Randolph has 15 years experience in aerospace, with a background in graphic arts, video, and operations planning. She has also taught classes at an experimental center for the arts in Ybor City, the Tampa Museum, and in the public school system.

She has a B.A. in Visual Arts and an M.A. in Education from the University of South Florida.